DOCUMENT RESUME

ED 257 276 EC 172 703

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TITLE Recognition of Learning Problems Accompanying Primary Handicapping Conditions and Their Impact on Instructional Programs for Multihandicapped Students.
PUB DATE Apr 85
NOTE 22p.; Paper presented at the Annual Convention of the Council for Exceptional Children (63rd, Anaheim, CA, April 15-19, 1985).
PUB TYPE Speeches/Conference Papers (150) -- Guides - Non-Classroom Use (055)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Cerebral Palsy; Elementary Secondary Education; Hearing Impairments; *Learning Problems; *Multiple Disabilities; Perceptual Handicaps; Sensory Experience; Visual Impairments

ABSTRACT

The paper addresses the secondary learning problems that accompany various types of cerebral palsy. Three major types of cerebral palsy are reviewed: spastic, athetoid, and ataxic. Among associated disabilities noted are disorders with the primitive reflexes (such as the moro and asymmetric tonic neck reflexes). Sensory impairments associated with cerebral palsy include disorders of touch (such as tactile defensiveness), proprioception (such as poor spatial relationships), auditory development (hearing loss, central auditory disorders, difficulties in auditory perception), and visual functioning (such as extraocular muscular imbalance, deficits in depth perception, and various central visual disorders). (CL)

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Recognition of Learning Problems Accompanying Primary Handicapping Conditions and Their Impact on Instructional Programs for Multihandicapped Students

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Presented at the Council for Exceptional Children's 63rd Annual Convention, Anaheim, California, April 16, 1985

EC172703

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Recognition of Learning Problems Accompanying Primary Handicapping Conditions and Their Impact on Instructional Programs for Multihandicapped Students

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The purpose of this paper is to develop the reader's awareness and knowledge about secondary learning problems that accompany many primary handicapping conditions. These problems may be due to (a) additional physical anomalies, (b) neuropsychological dysfunctions, and (c) very inappropriate environmental conditions. Whatever the cause(s), these learning problems may be more disabling than the primary handicapping condition itself. This paper is also intended to alert the reader to the negative impact these associated learning problems often have on the success of instructional programs implemented in the classroom or at home if these problems are not recognized and accounted for in the design of the instructional program. Suggestions will be provided throughout the paper for utilization of this information in planning and implementing successful home and school programs.

Since it would be impossible to address all major handicapping conditions and their unique learning problems, the various types of cerebral palsy have been selected as examples. Cerebral palsy is a relatively common handicapping condition and, hopefully, by the end of this paper the reader will be able to generalize this information to other major handicapping conditions, particularly those conditions in which the central nervous system is involved. Therefore, this information should help personnel set more realistic goals for their multihandicapped students.

Review of Cerebral Palsy

Presently, cerebral palsy is defined as a motor dysfunction secondary to a defect or lesion of the immature central nervous system (CNS) which consists of the brain, brain stem, cerebellum, and spinal cord. It is described as a disorder of movement, posture, and balance which begins in childhood due to the disruption of the nervous system function by the nonprogressive defect or lesion. This defect or lesion may occur before, during or after birth (Brown, 1980; Eiben & Crocker, 1983; Jones, 1983).

Three major types of cerebral palsy will be reviewed in order to reacquaint the reader with the unique motor characteristics of each before their associated learning problems are discussed.

Spastic Cerebral Palsy

According to Denhoff (1976) spastic cerebral palsy is the most predominant type of cerebral palsy, constituting 40-60% of this handicapped population. Spasticity is a motor dysfunction resulting from damage to nerve cells in the cortex of the brain (Brodman 's area 6 or a combination of Brodman's areas 4 and 6) and/or lesions somewhere along the neurons descending from the brain to the muscles (Keats, 1965; Jones, 1983; Marks, 1974). The spastic individual is able to voluntarily move the involved muscles but the pull of the spastic muscles causes movement to be slow and jerky with poor coordination (Bobath & Bobath, 1975). Batshaw and Perret (1981) describe the movement as having a clasped knife quality; as the limb is moved the initial resistance is strong, however, it gives way very abruptly, similar to the closing of a pocket knife.

Jones (1983) includes spastic hemiplegia, spastic paraplegia, spastic diplegia, and spastic quadriplegia as the four basic types of spastic cerebral palsy. These will be discussed briefly as they are referred to later and reflect other types of major handicaps.

Spastic hemiplegia. Spastic hemiplegia is the most common of the spastic group. One side of the body is affected due to the lesion being located in the motor area of the contralateral side of the brain. Dysfunction in the right cerebral hemisphere of the brain will cause spasticity on the left side of the body and vice versa. The upper extremity is usually more severely affected than the lower extremity and both will be smaller and shorter than the normal limbs if present since birth (Batshaw & Perret, 1981; Jones, 1983; Keats, 1965). Hemiplegia, presenting very similar characteristics may be caused by trauma to the head, blood clots in the brain, etc.

Spastic paraplegia. This type is quite rare, involving both lower extremities but sparing the upper extremities. The lesion may be located toward the top of the brain where the location of the motor neurons for the lower extremities is found (Jones, 1983; Keats, 1965). This type of disability could be similar to spinal cord injury, head injury, sequellae of meningitis, etc.

Spastic diplegia. Jones (1983) claims that this type of cerebral palsy is the most common type following premature delivery. Spasticity appears in both the upper and lower extremities but with greater involvement of the lower than the upper extremities. There is usually good head control and speech is unaffected. The lesion is located on the top of the brain in the motor area for the legs but

extends lower into the area controlling the upper extremities, thus involving them as well (Bobath & Bobath, 1975; Jones, 1983; Keats, 1965).

Spastic quadriplegia. Most quadriplegics have bilateral lesions, lesions on both sides of the brain, which involve all four extremities to some degree. There may be impaired swallowing, involvement of the pharynx, palate, tongue and face as well as trunk involvement (Boone, 1972; Jones, 1983) and speech is usually unintelligible or dysarthric. Spastic quadriplegia may result from other causes such as traumatic head injuries, infectious diseases, degenerative diseases, etc., and may have all or some of the same motor symptoms as the spastic cerebral palsied person described above.

Athetosis

Athetoids are present in 15-20% of the cerebral palsy population (Denhoff, 1976). This disability is described as a motor dysfunction resulting from damage in the extrapyramidal system, specifically in the basal ganglia. The extrapyramidal system normally coordinates muscle control and automatic movement patterns (Keats, 1965; Marks, 1974). Usually the athetoid's entire body is involved although the arms and trunk may be more involved than the legs (Bobath & Bobath, 1975; Jones, 1983). In contrast to the spastic condition, the involuntary movement is present in the athetoid, contributing to the difficulty in controlling voluntary movement and maintaining posture. Unfortunately, movements are intensified as the student consciously attempts to perform and emotionality only increases the involuntary movements (Batshaw & Perret, 1981; Jones, 1983).

Ataxia

Denhoff (1976) maintains that ataxics constitute only 1-10% of the cerebral palsied population. Their motor dysfunction results from a static lesion of the cerebellum or its pathways. Normally, the cerebellum controls balance and muscle coordination, refines movements, and maintains equilibrium (Ayres, 1979; Keats, 1965). Because of the awkwardness in movements requiring balance, posture, and spatial orientation, the ataxic may appear to be drunk or be mistaken as mentally retarded (Hallahan & Kauffman, 1978).

Associated Disabilities

Shapiro, Palmer, Wachter, and Capute (1983) determined that, in addition to the obvious motor impairments, approximately 60% of the cerebral palsied population has other associated dysfunctions and proposed the following alternative definition for cerebral palsy:

> A chronic neurologic disorder of movement and posture due to a defect or lesion of the immature brain. The motor disability serves as a neurodevelopmental marker indicative of associated cerebral dysfunctions such as mental retardation, learning disabilities, seizures, deafness, sensory loss, and other dysfunctions. (p. 87)

Their definition closely parallels Smith's (1983) philosophy. In her discussion of gross motor development she states that "one of the major reasons for noting motor delays lies in the subsequent scrutiny of whether or not these delays reflect a higher-level of cognitive information-processing difficulty" (p. 194). Although Smith is

addressing learning disabilities and they are concerned with cerebral palsy, both concepts indicate a broadening scope of concern which recognizes the importance of associated problems. Interestingly enough, both indicate the importance of the primitive reflexes on their specialization areas.

Primitive Reflexes: An Associated Problem

During the first six months of life, movement is primarily controlled by the brain stem, however, the primitive reflexes exhibited at this time normally disappear between three and six months of age. They diminish in influence or are integrated into voluntary movement patterns as the brain develops and begins to inhibit their free activity (Bobath & Bobath, 1975; Capute, Wachtel, Shapiro, Palmer, & Allen, 1983). Melyn and Grossman (1976) maintain that "much of the dysfunction in cerebral palsy relates to the persistence or exaggeration of these subcortical reflexes beyond the expected age of disappearance" (p. 82). The presence of these primitive reflexes interferes with gross and fine movement and may consequently impact on learning and the appropriate use of materials, equipment, and teaching techniques.

The following five major reflexes will be discussed to demonstrate their possible impact on the learning situation: Startle, moro, asymmetric tonic neck, symmetric tonic neck, and tonic labyrinthine. Information pertaining to these reflexes has been compiled from numerous sources (Batshaw & Perret, 1981; Bleck & Nagel, 1976; Jones, 1983; Palmer, Shapiro, Wachtel, & Capute, 1983).

Startle reflex. The student will respond to sudden unexpected stimuli such as a loud noise, a sudden bright light or quick movements

towards his face with total body extension (straightening) swiftly followed by flexion (bending) of his arms to his body midline with concurrent fisting of hands. Unfortunately, this response will interfere with sitting or standing balance and will preclude any hand activities for a short time. Since this reflex can be ellicited at any time, it is imperative that any unexpected stimuli be minimized in the student's environment if successful learning is to occur.

Moro reflex. The student will react to a sudden change in head position when sitting or semireclining by throwing his head far back; throwing his abducted (outwardly rotated), extended arms and extended, spread fingers out widely; and immediately bringing his arms into an "embrace" position. In order to eliminate possible stimulation of this reflex, it is imperative to ensure adequate head and trunk support so that the student is in a good, secure position. It is also important to ensure that no quick or unexpected head movements occur. This reflex will also interfere with any learning as it will interfere with any concentration or attention on the part of the student if he does not feel secure or unexpected head positions occur.

Asymmetric tonic neck reflex. This is called the "fencer's position." When the student's face is turned towards one side, the arm and leg on the opposite side flex and the arm and hand on the same side extend. Unfortunately, when this position is assumed eye-hand coordination is inhibited particularly in relation to the center of the body. If this reflex is present and active for several years, scoliosis and/or hip dislocation due to the inequality of muscle tone may occur. It is important that the student be positioned

appropriately wherever he is going to work so that the positioning of his body does not require the unwanted head movement. Objects or other materials should also minimize assumption of the unwanted position by being presented on the side opposite to that to which the face turns and the position is assumed or by placing them in the student's midline. If someone works with this student it is strongly suggested that the instructor sit directly across from the student so that the activity or materials are presented with the student's head in a neutral position.

Symmetric tonic neck reflex. If this reflex is still present, two opposite body positions can result. If the student's head is flexed (moved downward) his upper extremities will also flex but the lower extremities will extend. However, if the head is hyperextended (bent backwards) the upper extremities will extend and the lower extremities will flex. Either of these responses to head movement will limit individual movement of body parts because the arms and legs move in response to the head position. It is suggested that the student's body be positioned so that the unwanted head movement is not required and that the activities be presented at eye level thus maintaining the head in a neutral position.

Tonic labyrinthine reflex. In the classroom this reflex could interfere with sitting. When the head is lifted, extending the neck, the student falls backward due to accompanying trunk (body) extension. The best precaution is to keep the head in a neutral position when sitting is required if this reflex is still in evidence.

Sensory Involvement: An Associated Problem

There is very strong evidence that defective sensory functioning may be, in part, responsible for defective motor functioning and learning.

Touch (tactile). In 1964 McDonald and Chance stated that there was increasing evidence that many cerebral palsied individuals have disturbances of tactile perception and sensitivity. Marks (1974) agreed and cautioned that these individuals may also have tactile after-images (tactile perseveration) which appear to interfere with tactile discrimination. This problem could complicate the use of tactilely oriented materials or teaching techniques unless care is taken to allow the after-image to disappear before continuing the activity. Capute (1975) cautioned that a hemiplegic may have diminished awareness of light touch on his affected side. In that case, it is suggested that the unaffected hand be used for tactile discrimination or letter tracing if accurate learning or evaluation is to take place.

Tactile defensiveness was first addressed by Ayres (1972) in her discussion of the learning disabled. She described it as a "sensory integrative dysfunction in which tactile sensations cause excessive emotional reactions, hyperactivity or other behavior problems" (1979, p. 184). Experience has indicated that the spastic quadriplegic or diplegic may be tactilely defensive over the entire body and/or especially around the oral region or within the mouth. The presence of this condition may cause difficulty with feeding the student due to the presence of another's hands positioning the student's face.

Sensitivity inside of the student's mouth may make him sensitive to different textures of food and utensils. Anticipation of unexpected touching may also aggravate the spasticity as well as the behavior. A precautionary word is in order. This tactile system can respond in some very serious ways if overstimulated. It is strongly suggested that anyone suspecting a student of being tactilely defensive should have a trained therapist assess and program for development of tactile tolerance.

Proprioception. Gaddes (1980) defined proprioception as input from muscles and joints which provides awareness of the body in space and an awareness of the body's movements. An awareness of existing body parts, their locations and accompanying sensations associated with movements and positional sense must be developed in order to learn the appropriate movement patterns. An individual must be positioned so that normal proprioceptive sensations are received or inappropirate sensations from abnormal body positioning will be accepted in lieu of the normal because the individual has had no opportunity to compare and differentiate between them (McDonald & Chance, 1964). An ataxic is an excellent example. This individual suffers incoordination due to the disturbance of the proprioceptive awareness of his body. His speech may also be affected due to the lack of appropriate proprioceptive information concerning the position of his tongue in his mouth (Marks, 1974).

While lack of normal proprioception interferes with mobility, feeding, eating, and other activities involving body movement it also contributes to a poor body concept (knowledge of position and

location of body parts or their relationship to each other). Lack of appropriate input from both the proprioceptors and the tactile system also contribute to poor spatial relationships because the body acts as a reference point for the individual's knowledge of his space world. That individual must be able to perceive objects in relation to himself as well as positional relationships between self and objects and objects and objects (Waugh & Bush, 1971). Until he builds a body concept from the proprioceptive and tactile sensations he cannot become the focal point of his space world. In order to develop an awareness of body parts, locations, and sensations related to them it is suggested that (a) body parts be named as diapers are changed, children are lifted, feeding occurs; (b) directional phrases are used during activities to help the student project a sense of direction to himself and outside of his body; (c) the student be positioned so that he can see his other body parts; and (d) equipment such as plastic trays on wheelchairs be used so that all body parts are visible.

Auditory. An individual with cerebral palsy is at greater risk than the general population for auditory dysfunction: conductive, sensorineural or central. However, the most frequent type of loss is sensorineural in nature. The damage occurring in the cochlea and/or the eighth cranial nerve cannot be medically or surgically repaired. Both acuity problems and difficulty understanding speech are associated with this damage (Yost & Macmillan, 1983). Speech is distorted rather than clear because the auditory mechanism cannot handle the continuous pitch and loudness changes that occur

in the speech pattern. The greatest damage is usually found in the area of the cochlea (inner ear) where high frequency sounds are received such as f, v, s, sh, th, t, p, and k. Unfortunately, these students may be overlooked in early life because they respond to many noises and sounds (McDonald & Chance, 1964). It is not unusual for many multihandicapped students to have additional problems with ear infections such as otitis media, therefore, it could prove beneficial to check any multihandicapped student for such a loss. In order to assess the presence of a sensorineural loss, watch the student's reaction to environmental and speech sounds. Some students become excellent lip readers, using the visual reinforcement to fill in the auditory gaps. It is suggested that some noises and speech should occur outside of the student's field of vision and note be taken of the response or lack of response to indicate the possible existence of this problem. If a loss is suspected, further definitive testing should be done. When working with this student be sure to reinforce any verbalization with visual input so that the student is able to fully comprehend the information.

Nober (1976) claims that there is also a great incidence of central auditory disorders in the cerebral palsied since they have primary brain pathology. Again, these same problems could be typical of other multihandicapping conditions in which brain pathology is involved. The problem is not in the reception of sound but in the ability to perceive and integrate it. "Indeed, the problem is auditory processing at the higher perceptual and cognitive levels"(Nober, 1976, p. 237). Lerner (1981) defined perception as the ability to recognize

or interpret what is heard. In order to differentiate more specific auditory functions, Lerner divided perception into the following subskills: auditory discrimination (identification of the same or different words), auditory memory (storage and recall of what has been heard), auditory sequencing (remembering the order of verbal items), and auditory blending (blending single phonic sounds into a complete word). A lack of any of these subskills could contribute to speech and language deficits and certainly will influence higher cognitive skills. Again, integration of one or more of the student's stronger modalities into the learning experience should assist the student in comprehending much of the verbal material in greater detail.

Visual. The individual with cerebral palsy is also at greater risk than the general population for visual problems such as extraocular muscle imbalance, refractive errors, and central visual disorders. While approximately 25 to 35 percent of cerebral palsied individuals have hearing deficits more that 50 percent have visual problems (Jones, 1983). Strabismus is the most common ocular abnormality and is characterized by the inward deviation of one or both eyes (esotropia) or the outward deviation of one or both eyes (exotropia) (Batshaw & Perret, 1981; Mitchell, 1983). Other muscular imbalances include hypertropia (one eye turning upward), hypotropia (one eye turning downward) and diplopia which is due to muscle imbalance resulting in double vision from the two different images which cannot be fused into one image in the visual cortex of the brain (Batshaw & Perret, 1981; Boone, 1972; McDonald & Chance, 1964). Batshaw and Perret caution

that a person with strabismus may tilt his head until the two images fuse although the muscular imbalance is still present. An individual with any of the other muscular defects may also assume an extremely abnormal posture to compensate for the muscular imbalances present in the various conditions. Nystagmus (quick, jerky movements of the eyes) is often seen in ataxics (Bieck, 1975; Marks, 1974). Again, this condition may affect head position as the individual attempts to find the posture in which the least eye movement occurs (Mitchell, 1983). Another muscular dysfunction that is called supravision gaze palsy (loss of vertical eye motion or the inability to look either upward or downward) is found in some athetoids. It is extremely important, in this case, to ensure that materials are placed so that the usually intact horizontal movement can be utilized as the maximum field of vision without requiring the assumption of an extremely abnormal posture.

A deficit in depth perception is due to a combination of ocular muscular imbalance and visual perceptual problems (Mitchell, 1983). A lack of depth perception may be the reason that walking activities or other mobility activities are not successful rather than the motor problem. Therefore, it is imperative that testing for depth perception be done when problems with crutches or walkers occur. If it is present, depending upon the student's capabilities, depth perception training can be done utilizing texture gradient, size changes, color changes, and eye movements.

Undoubtedly, primary brain pathology is also responsible for the various central visual disorders noted in cerebral palsied students.

Marks (1974) suspected an increased frequency of several different types of color blindness in the cerebral palsied and other neurologically impaired populations. These included: monochromatic (discrimination of hues and saturations only), dichromatic (perception of only two of the three basic colors), and total (perception of black, grey, and white). If a student does not respond to color coded teaching materials, the possibility of color blindness should be investigated thoroughly before any decisions are made to change teaching levels or teaching techniques. If color blindness of some kind is found, the materials can be adjusted and instruction may have to depend upon other attributes of teaching materials such as size and shape. Visual-motor dysfunction is also very evident in this group (Boone, 1972). However, it is imperative that each individual's capability in this area be assessed and developed to its maximum to assist him in leading as independent a life as possible. When working on tasks utilizing visual-motor coordination, remember that the difficulty of the task should vary depending upon the degree of motor and visual involvement. When the development of visual-motor coordination is the primary objective, it is usually most beneficial to use familiar tasks to reach that objective rather than introducing a totally new task which will require the student's entire attention and concentration to learn. This would leave little energy to attempt the visual-motor component. Cruickshank, Hallahan, and Bice (1976) claim that spastic cerebral palsied individuals have more difficulty with figure-ground discrimination. "The child with a deficit in this area cannot focus on the item in question apart from the visual background" (Lerner, 1981, p. 210). However, Mays (1978) found that spastics responded

well when a black background and white figures were used. Perhaps this was successful because perception of white form on black ground seems to be more developmentally primitive than the reverse (Marks, 1974) and student success could depend upon selection of the most appropriate developmental level when presenting a task. Other suggestions for minimizing this problem include: an increase in the stimulus values such as color and size of the learning materials, use of three-dimensional materials before two-dimensional, and a decrease in distracting stimuli within the environment. Cruickshank et al. (1976) stated that "a pathology in this normal figure-background relationship has been demonstrated many times in individuals of different clinical classifications with central nervous system disorders" (p. 162). Therefore the above suggestions could be adapted for other neurologically involved populations demonstrating a deficit in this area.

Approximately 25-50 percent of spastic hemiplegics have a loss of either the left or right field of vision, depending upon the affected cerebral hemisphere of the brain. If the right hemisphere is damaged the left visual field will be lost as well as normal motor function on the left side of the body. The same contralateral dysfunctions would occur on the right side of the body if the left hemisphere were damaged. Informal observation of the hemiplegic's approach to a task and his head position while working should alert the observer to the presence of this problem. Another clue is the hemiplegic's inability to visually attend to objects approaching from his affected side until the objects reach the midline of his body. Materials should

be placed in the appropriate visual field so that the hemiplegic can see the materials easily without having to assume an abnormal body position in order to locate the material visually.

Conclusion

There can be little doubt that these associated problems are reflected in the student's overall performance. Capute (1975) stated that approximately 50-60 percent of the cerebral palsied population may be diagnosed as mentally retarded due to a significant reduction in normal sensory input, perception, and motor skills. While reduced intelligence in this population may be attributed to dysfunction in these areas, deprivation of environmental experiences may further compound the issue (Boone, 1972).

Considering the numerous types and possible combinations of associated problems that have been presented, it is imperative that personnel involved in evaluation and program planning adapt testing or teaching materials and techniques to minimize or remediate these problems. Only when this occurs will the multihandicapped student be able to perform to the maximum of his abilities.

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